Tabletop Piston Filler Automation Package Operation Manual

V1.1

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1.1 SAFETY

1.2 GENERAL SAFETY

Apex Filling Systems, LLC (APEX) manufactures and designs all of its products so they can be operated safely. However the primary responsibility for safety rests with those who use and maintain these products. The following safety precautions are offered as a guide that if conscientiously followed, will minimize the possibility of accidents throughout the useful life of this equipment. The safety of personnel, equipment and plant facilities should be considered during equipment operation and with each changeover of product, or any machine modifications.

Only those who have been trained and delegated to do so and have read and understood this operator's manual should operate the equipment. Failure to follow the instructions, procedures and safety precautions in this manual can result in accidents and injuries.

DO NOT modify the equipment except with written factory approval. Unauthorized equipment modifications will void the warranty.

Each day walk around the equipment and inspect for leaks, loose parts, missing or damaged components, and parts out of adjustment. Perform all recommended maintenance noted in this manual.

EQUIPMENT SHOULD <u>ALWAYS</u> BE DE-ENERGIZED (POWER AND AIR) BEFORE MAKING MECHANICAL ADJUSTMENTS.

1.3 ELECTRICAL SHOCK

- ✓ To avoid electrical shock hazard, make sure this equipment is properly grounded.
- ✓ Dangerous voltages are present within the electrical enclosures. DO NOT operate this equipment with electrical covers open or removed.
- ✓ Keep all parts of the body, hand held tools, or other conductive objects away from exposed live-parts of the electrical system. Maintain dry footing and stand on insulating surfaces. DO NOT contact any portion of the equipment when adjusting or making repair to exposed live parts of electrical system.
- ✓ Attempt repairs only in a clean, dry, well-lighted, and ventilated area.

1.4 CONTACT MATERIALS COMPATIBILITY

APEX endeavors to make all contact parts compatible with buyer's products, if known. Because of the wide variety of possible products, Apex Filling Systems, LLC cannot be responsible or liable for ensuring compatibility of contact material with the products. Evaluate material compatibility prior to machine use. Failure to follow this procedure can result in machine damage, fire, operator injury or death

1.5 SAFETY COMPLIANCE LIABILITY

APEX endeavors to make machinery as safe to operate as possible. National, state and local laws related to safety in the workplace apply primarily to the responsibilities of the employer, and not the equipment manufacturer. The seller agrees to cooperate with the buyer in finding feasible answers to compliance problems. However, because APEX has little control of the many factors which may significantly affect the environment in which this equipment is installed, the seller does not warrant this equipment to be in compliance with OSHA or any like state or local laws or regulations. It is the buyer's responsibility to provide the modifications necessary to assure compliance with the laws and regulations at the point of installation.

A complete inspection of product is necessary until the machinery is proven to produce acceptable results. This should also be performed after every changeover.

1.6 CONVENTIONS

To ensure the safety of personnel which will install, adjust, maintain and operate this equipment, it is imperative that they understand the dangers, warnings and caution notices. It is important to understand the ***signal words*** that may be used throughout this manual.

	Alerts to immediate hazard, which will result in death or severe personal injury, if not avoided
	Alerts to a hazard which will result in serious injury, or death in some cases, if not avoided.
	Alerts to a potential hazard that may result in a serious personal injury, if not avoided. It also alerts against an unsafe practice that will permanently damage equipment or property.
IMPORTANT	Indicates a suggestion as to how to use or adjust the equipment for best product results.
NOTE	Points out a proper use that will avoid damage to the equipment, or will extend the life of the parts.

2.1 MACHINE FEATURES & SPECIFICATIONS

2.2 INTRODUCTION

APEX Tabletop Piston Filler Automation Upgrade Package is an economical upgrade package which allows a tabletop piston filler to be run automatically with a conveying and container indexing system. Optional upgrades include diving heads, automatic clean-out functions, and other options as needed for various applications.

2.3 FEATURES & BENEFITS

- **Easy Changeover**
  Simple mechanical adjustment for different bottle sizes. Quick to changeover, simple to use and easy to clean
- **Robust**
  Stainless steel shells, frames, legs and housings maximize the working life of your machine, and minimize maintenance costs and downtime
- **Customizable**
  Whatever the production need, APEX has a design to meet
- **Flexible**
  Versatility and Simplicity are intrinsic to the design. Many container sizes and shapes, and many products can be run on one machine

2.4 PERFORMANCE SPECIFICATIONS

Dispensing Speed: up to 50 cpm (varies per application)
Dispensing Volume: .2-169oz (5-5000ml) depending upon piston and cylinder combination
Operating Temperature: 32 to 122 Degrees F (0 to 50 Degrees C) /
10% to 95% RH (non condensing)

2.5 ELECTRICAL SPECIFICATIONS & REQUIREMENTS

Electrical Requirements: 120VAC / 50/60Hz / 1 Φ / 30A
Automation package requirements will vary per application.

2.6 AIR SPECIFICATIONS & REQUIREMENTS

Compressed Air Consumption: 3 CFM (5.1m³/h) @ 70 PSI (5 kg/cm², .5MPa)
clean, dry compressed air (not-oiled)
Automation package requirements will vary per application.

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3.1 INSTALLATION & START-UP

3.2 INSTALLATION PROCEDURES

The filling unit should be placed on a solid, level foundation, the fill bar and fillheads should be centered over the container conveyor. Electrical connections should be properly terminated into the main electrical enclosure by properly trained technicians, and appropriate supply voltage, proper phase and adequate supply amperage should be verified prior to powering up the equipment. Compressed air lines should be run and are generally connected to the air inlet(s) with quick-disconnect air fittings.

3.3 START-UP & COMMISSIONING

This manual should be read completely before powering-up the Machine. Commissioning of the Machine should be performed by a trained technician only after complete understanding of the Machine, and with products that match samples indicated to Apex Filling Systems, LLC if supplied.

- Check the machine to see that guards are in place
- Check the mechanical system for loose or missing parts

General start-up procedure after mechanical adjustments/set-up has been performed, sensors aligned properly, and timers set and verified:

- Ensure the E-STOP button is depressed (*Fig 3-1*)
- Ensure product is available to the filler inlet(s)
- Ensure adequate air supply is available to the filler inlet(s)

Figure 3-1
Emergency Stop

Figure 3-2
Main Disconnect

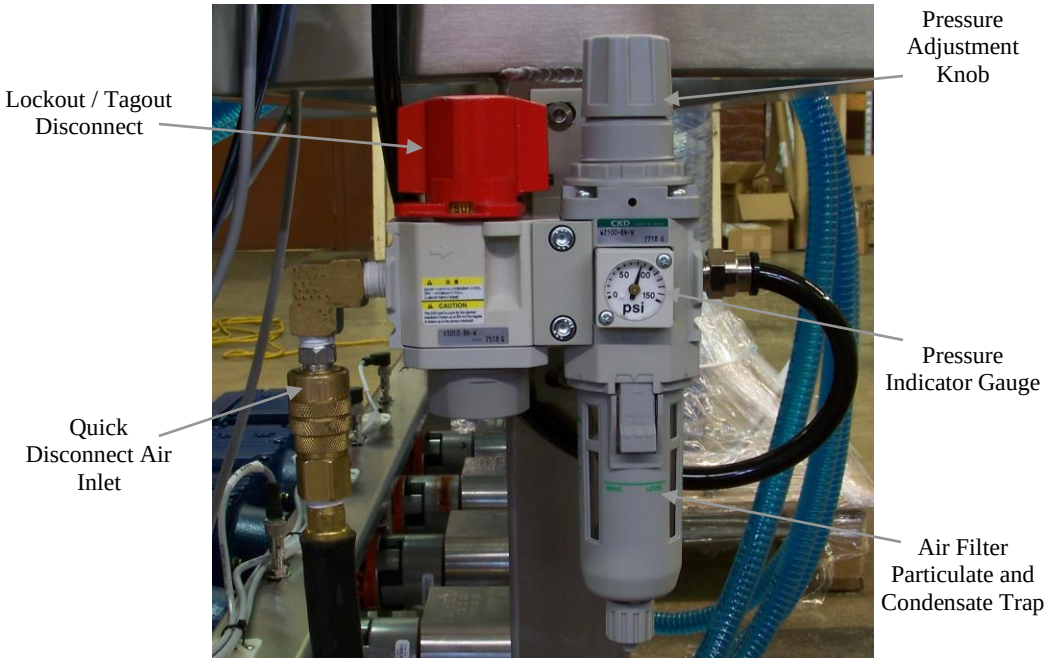

Figure 3-3
Main Air Disconnect and Filter Regulator

Air cylinders may act unexpectedly and extend or retract quickly when compressed air is connected or disconnected from equipment. Keep clear of equipment to avoid possible injury

- Remove any lock-out/tag-out devices and rotate the main air inlet to ON
- Verify the pressure is set correctly with the Pressure Adjustment Knob (typically 70psi)
- Remove any lock-out/tag-out devices and rotate the main power disconnect to ON
- Rotate E-STOP to ON
- If machine is equipped with product supply controls, turn on supply, either through the touch screen or with manual toggle switch
- Start machine filling cycle from the touch screen controls
- Watch closely for machine or container jams, overfill or underfill conditions, and be ready to press E-STOP button. Adjust and rectify any issues as necessary.

Mechanical adjustments are described in section 5, control adjustments in section 6.

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4.1 OPERATION

4.2 THEORY OF OPERATION

APEX Piston fillers are versatile and easy to use, able to fill a wide range of product and designed with quick and simple changeover and cleaning in mind. The piston is driven by an air cylinder which has magnetic air valves to determine the stroke length. When the piston is pulled back, product is drawn into the piston cylinder. With the SPT series, thin product is pulled through the three-way slide valve (a spring loaded one-way check valve). With the SPV series, thicker product is pulled through an actuated three-way rotary valve. When the piston is pushed forward, the bottom close nozzle is opened, and product is pushed out into a container. When the piston cylinder reaches the adjustable front limit switch, the bottom close nozzle closes, the air cylinder retracts, drawing product into the piston cylinder for the next cycle.

The automation package increases the filler's output capabilities, allows for automatic container indexing, and results in higher outputs than could generally be expected with manual or semi-automatic operation. A simple operator interface touch screen allows access to the various timers which control the filler's operation, the conveyor indexing pins, dive cylinders, container count sensors, dive limit sensors, etc.

In addition to the typical piston filler operation and maintenance, there are two primary sections to note regarding the upgrade:

- Mechanical Adjustments
- Automation Controls

5.1 MECHANICAL ADJUSTMENTS

5.2 AUTOMATION PACKAGE COMMON MECHANICAL ADJUSTMENTS

1. FILL BAR IN/OUT ADJUSTMENT
2. FILL BAR HEIGHT ADJUSTMENT
3. DIVE STROKE AND HEIGHT ADJUSTMENT
4. FILL HEAD SIDE TO SIDE ADJUSTMENT
5. FILL HEAD OPEN AND CLOSE ADJUSTMENT
6. INDEXING PIN ADJUSTMENT
7. CONTAINER SENSOR ADJUSTMENT

5.3 FILL BAR IN/OUT ADJUSTMENT

As shown in *Fig 5-1*, the fill bar is mounted with two horizontal mount shafts. To adjust the fill bar in and out, loosen lock bolts and slide in or out as needed to align the fill head nozzles over the center of the product conveying conveyor.

5.4 FILL BAR HEIGHT ADJUSTMENT

The overall fill bar height is adjusted up or down by rotating the fill bar height adjustment wheel, typically located at the top of the fill bar mount assembly, as shown in *Fig 5-1*. Looking from the top down, rotate the knob clockwise to raise the fill bar, and counter-clockwise to lower the fill bar.

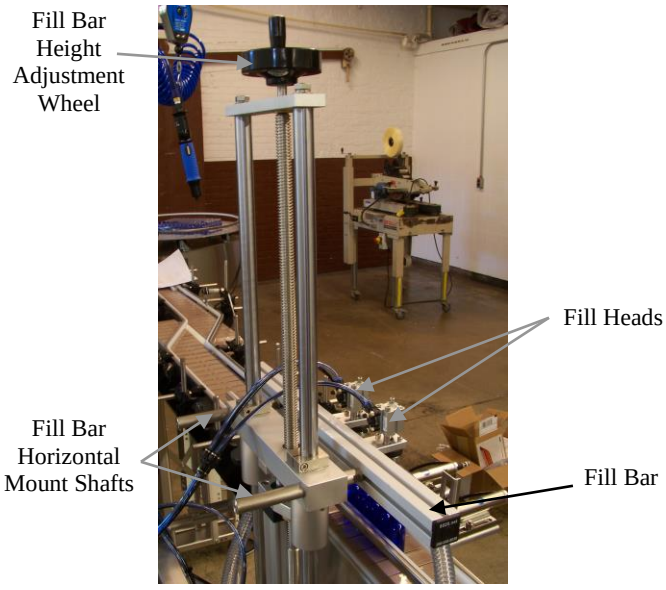

Figure 5-1
Fill Bar Adjustments

5.5 DIVE STROKE AND HEIGHT ADJUSTMENT

Figure 5-2
Dive Stroke & Height
Adjustments

The dive stroke length is determined by the distance the dive cylinder piston is allowed to travel. The lower limit is set by adjusting the lowest height with the cylinder retracted, and raising or lowering the dive cylinder with the fill bar height adjustment wheel. The upper limit is set by raising or lowering the dive upper limit stop blocks as shown in *Fig 5-2*.

Longer nozzle tips can be used to dive deep into a container neck, if for instance, the product being filled has a tendency to pile, making it necessary to have the fill nozzle close to the product level to achieve a full container. Deep diving can also be used to subsurface fill products which have a tendency to foam, reducing the foam produced during the fill cycle.

5.6 FILL HEAD SIDE TO SIDE ADJUSTMENT

Fill heads are easily adjusted side to side to accommodate a wide variety of container diameters by loosening the adjustment knobs which mount the fill head mount brackets to the fill bar and sliding the fill heads as needed.

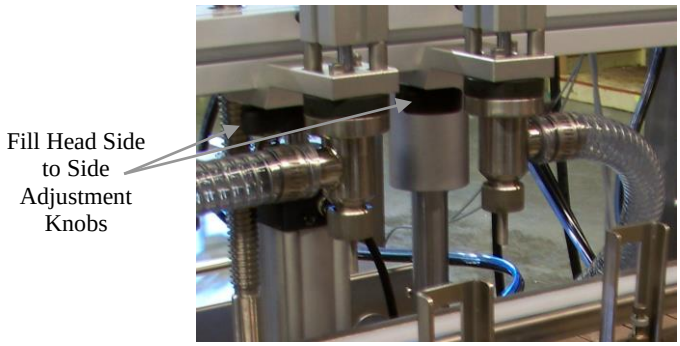

Figure 5-3
Fill Head Side to Side
Adjustment

5.7 FILL HEAD OPEN AND CLOSE ADJUSTMENT

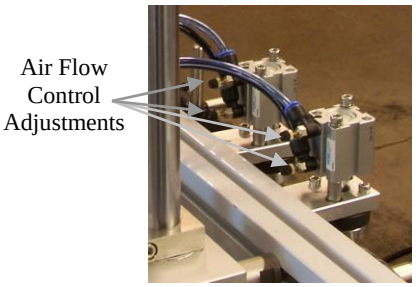

Figure 5-4
Fill Head Open and Close Air Flow Control Adjustment

Air flow control valves are located on each fill head actuator, as with most air cylinders used in process equipment. Flow control valves used are "meter-out" valves, meaning that they only restrict air flow in one direction, while the cylinder exhausts. In order for the fill head to close more quickly, the lower air flow valve needs to be adjusted by turning the adjustment knob counter-clockwise (opening up the exhaust port) and vice-versa. Generally, the best results are achieved by adjusting the speed of the fill heads opening and closing as quickly as possible, without causing the product to "spit" at the end of a fill.

It is especially important for the fill heads to open quickly at the beginning of the fill cycle, otherwise the fill pistons may start to dispense the product before the fill heads are completely open, causing a build-up of pressure in the product lines.

If, at the beginning of the fill cycle, product is dispensed "violently" into the containers, speed up the fill heads opening, and/or slow the piston forward flow control valve, located on the piston filler itself.

5.8 INDEXING PIN ADJUSTMENT

Air cylinders located on the mount rail on the front of the conveyor act as entry and exit gates to control the container movement into, and out of, the fill area.

Shown in *Fig 5-5*, the gates (or "pins") are mounted on either side of the fill area. In the picture, the line direction is left-to-right, and so, the entry gate is located on the left, and the exit gate on the right.

Entry and exit gates are adjusted side to side by loosening the bracket mount bolts and sliding the mount brackets as needed.

Figure 5-5
Indexing Cylinder Adjustments

5.9 INDEXING GATE PROPER POSITIONING

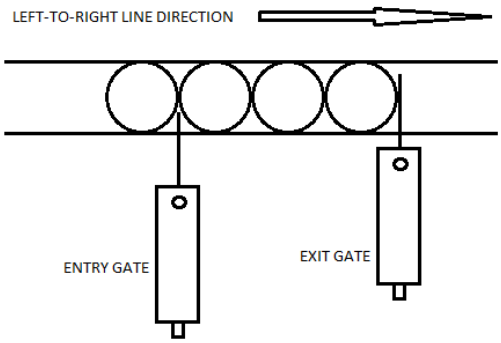

Figure 5-6
Indexing Gate Positioning

Guidelines for proper positioning of indexing cylinders:

- Entry Gates generally only extend across the conveyor far enough to hold back empty containers, so that full containers can exit the fill area, creating a gap between containers into which the exit gate will extend between fill cycles
- Exit Gates typically extend more than halfway across the container width, to positively control the container location, and more effectively hold back full containers
- As with container guide rails, gates generally control containers best when they are positioned low on the container, close to the conveyor belt. Uniquely shaped containers may require different positioning for proper control.

5.10 CONTAINER SENSOR ADJUSTMENT

Figure 5-7
Typical Container
Sensor

Fig 5-7 shows a typical container sensor, located prior to the fill area (upstream). A variety of sensors can be used, depending upon the types of containers which need to be properly sensed.

Container sensors are typically used for three purposes:

- COUNT EYE: Counts containers as they pass. Sensor must be adjusted so that each container that passes sends a positive, distinct signal to the controller, as well as a clear signal between containers
- N.B.N.F. EYE: Located upstream from the fill area, a "No Bottle, No Fill" sensor verifies that there are sufficient containers available. It is generally an additional eye located even further upstream from the Count Eye, to ensure a proper upstream backpressure so containers will index properly, but a Count Eye can sometimes be used for both functions. Regardless of the design used, the sensor will need to be blocked for a period of time, dictated by the timer settings in the controller. See Section 6, or refer to the appropriate controller manual for additional information
- JAM EYE: Located downstream from the fill area, a Jam Eye Sensor is used to detect that there is not sufficient room for full containers to exit the fill area, which could cause a bottle jam, spill, etc. Again, a Jam Eye sensor needs to be blocked for a period of time specified by timers set in the controller, to either pause the fill cycle, trigger an alarm, or other action notifying machine operators that a Jam Condition exists.

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Adjusting container sensors is often as simple as placing the sensor at an appropriate height on the container, and distance from the container. Some sensors have sensitivity adjustments, allowing for fine tuning. Many sensors are proximity based, some sensors are reflective, using a reflector mounted opposite the sensor, others use two sensors (one as sender, the other as receiver), and other sensor types can be material sensitive (such as sensing a metal container.) The appropriate sensors used are dependent upon the type of containers which need to be sensed.

Refer to the machine specific documentation for additional information.

5.11 PISTON STROKE (FILL LEVEL) LIMIT SWITCHES

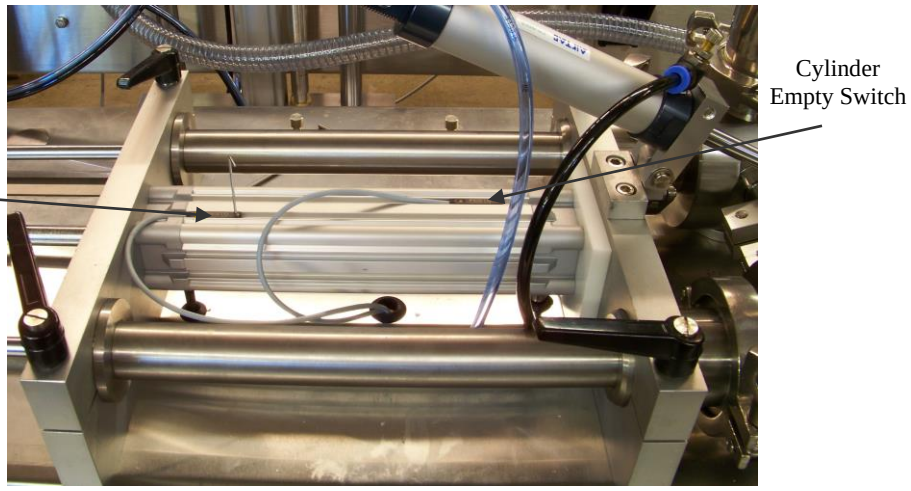

Figure 5-8
Magnetic Reed Switches
(Cylinder Position Sensors)

The primary difference between a standard (pneumatic only) tabletop piston filler and a filler equipped with an automation package is the type of sensor used to determine the location of the piston's drive cylinder. With a tabletop system, a pneumatic switch is used, and with an automation upgrade, an electric switch is used. Both work on the same principle, sensing the magnet inside the air cylinder. The location of the sensor determines the stroke length, and therefore, the amount of product which will be dispensed per stroke.

Using an allen wrench, adjust the Cylinder Full Switch toward the Cylinder Empty Switch (also known as the Cylinder Home Switch) to decrease the stroke, and away from the Cylinder Empty Switch to increase the stroke.

IMPORTANT The Cylinder Empty Switch should not be moved, unless it does not sense the cylinder magnet when the piston is empty. To adjust fill levels, it is only necessary to adjust the Cylinder Full Switch

6.1 CONTROLS

6.2 MAIN CONTROL SCREEN

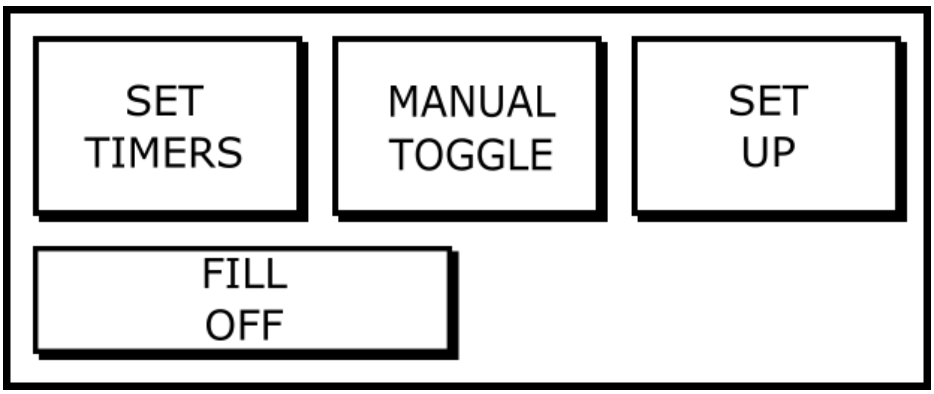

Figure 6-1
Main Control Screen

From the main control screen, the various sub-screens and timers can be accessed.

The top three buttons will access sub-menus, and the bottom left button (in *Fig 6-1* "FILL OFF") will toggle between idle and filling and indexing run cycling.

6.3 SET TIMERS SCREENS

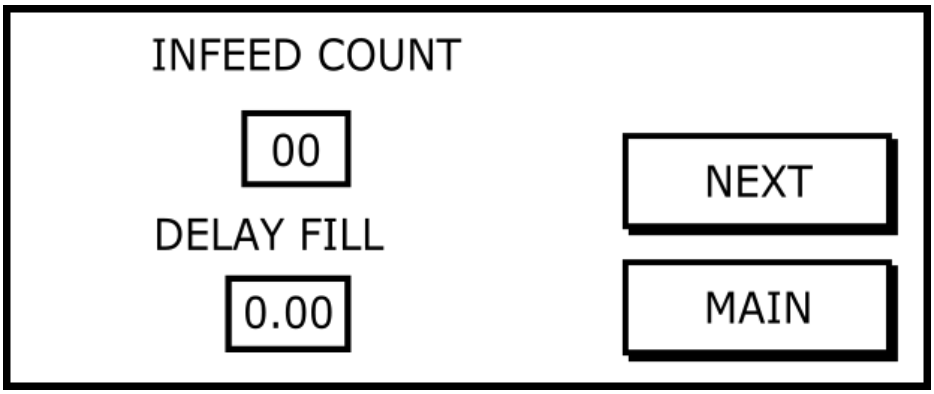

Figure 6-2
Set Timers Screen 1

On the first timer screen there are two settings accessed.

INFEED COUNT: Defines the amount of containers which the program requires sensing from the container sensor before the fill cycle will begin

DELAY FILL: This is a timer which will delay the fill cycle from starting after the INFEED COUNT has been satisfied (and time after N.B.N.F. timer has expired, if equipped)

Pressing NEXT advances to the next Set Timers Screen, MAIN returns to the Main Screen.

Pressing directly on any numeric entry box will bring up a numeric entry pad, as shown in *Fig. 6-3*

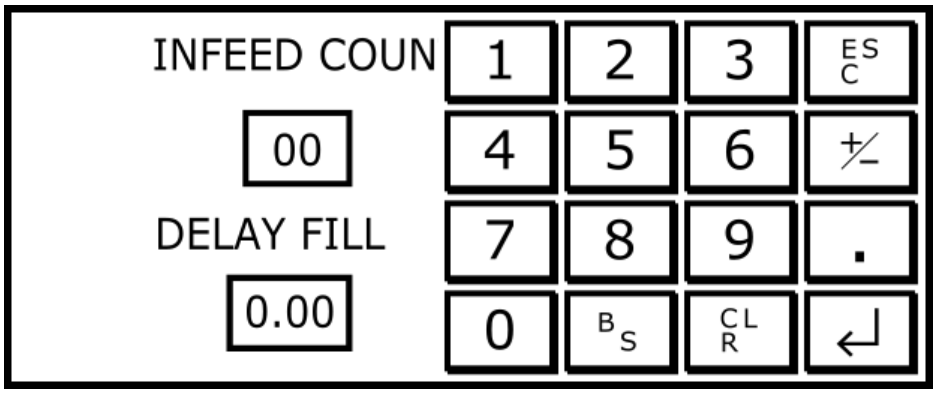

Figure 6-3
Numeric Entry Pad

From this pop-up window, numbers can be directly entered into the program parameters. Pressing ENTER (the lower rightmost button) will save the entry and return to the original screen.

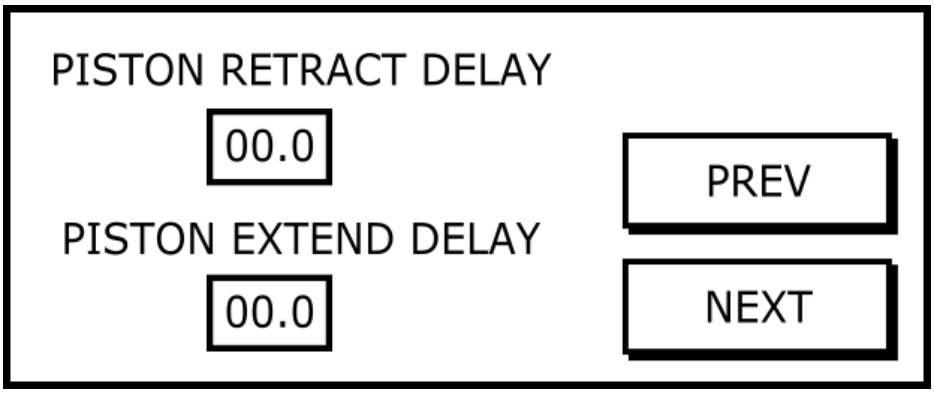

Figure 6-4
Set Timers Screen 2

PISTON RETRACT DELAY: This is the amount of time, after the Cylinder Full Switch senses the piston's location as full, before it retracts for the next cycle

PISTON EXTEND DELAY: This is the amount of time, after the Cylinder Home Switch senses the piston's location as empty, before it extends to fill the next container

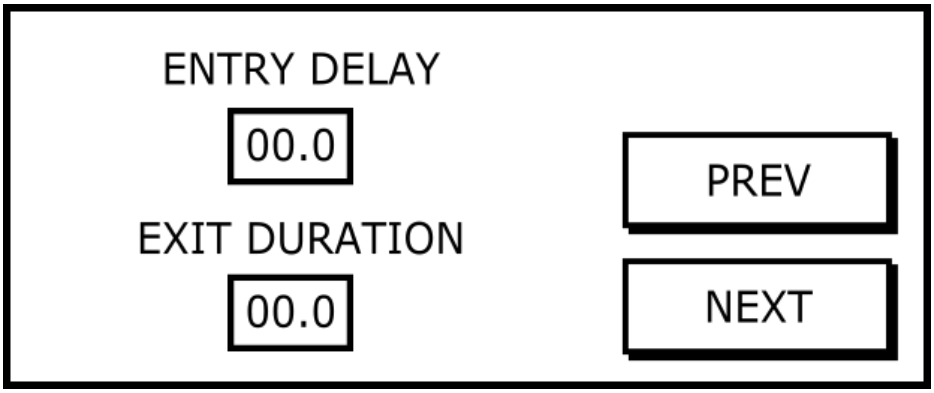

Figure 6-5
Set Timers Screen 3

The third timer screen access timers which control the indexing gate timers (*Fig. 5-5*)

ENTRY DELAY: This is the amount of time which the Entry Gate will remain extended, holding back empty containers after the fill cycle has ended, and full containers exit the fill area. A longer delay will create a larger gap between full containers exiting the fill area, and the empty containers entering the fill area for the next cycle

EXIT DURATION: This is the amount of time which the exit gate remains open to allow the full containers to exit the fill area.

IMPORTANT Any time the conveyor speed is changed, make sure to verify the indexing works properly. Adjust as needed to avoid container jams and/or spills.

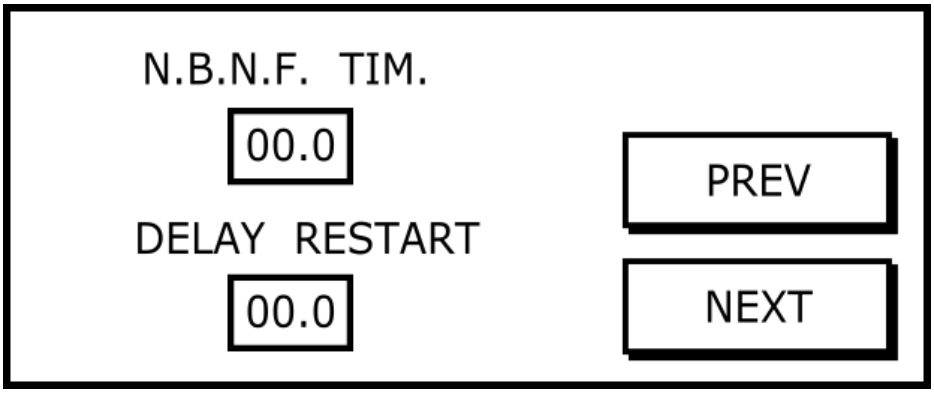

Figure 6-6
Set Timers Screen 4

N.B.N.F. TIM.: "No Bottle, No Fill" Timer is the amount of time which the container sensor upstream from the fill area must sense a container before the fill will start. This can either be a dedicated sensor, or the count sensor can serve to verify containers are present, depending upon the application

DELAY RESTART: This is the amount of time which the filling and indexing cycles will pause between cycles. This is useful to slow the output of the machine if it is necessary for downstream operations to complete properly

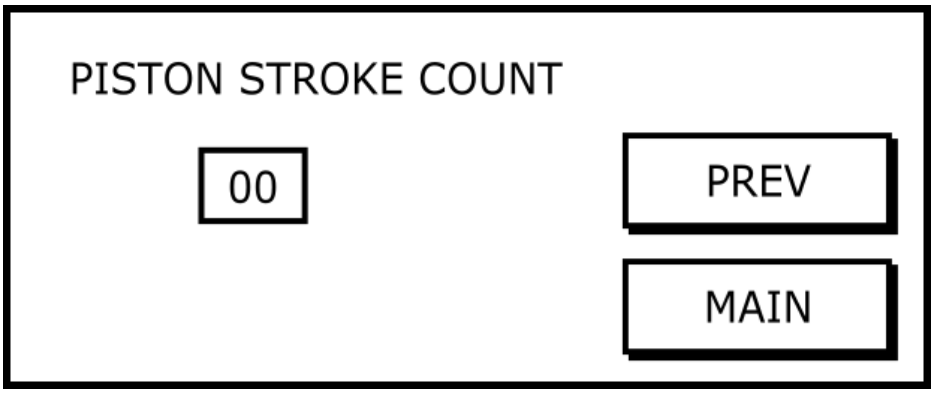

Figure 6-7
Set Timers Screen 5

On the final timer screen, the number of strokes per cycle can be adjusted

PISTON STROKE COUNT: This is the total number of strokes per cycle which the piston(s) will make. This makes it possible to fill larger volumes of product into containers than a single stroke would be able to achieve

6.4 MANUAL TOGGLE SCREENS

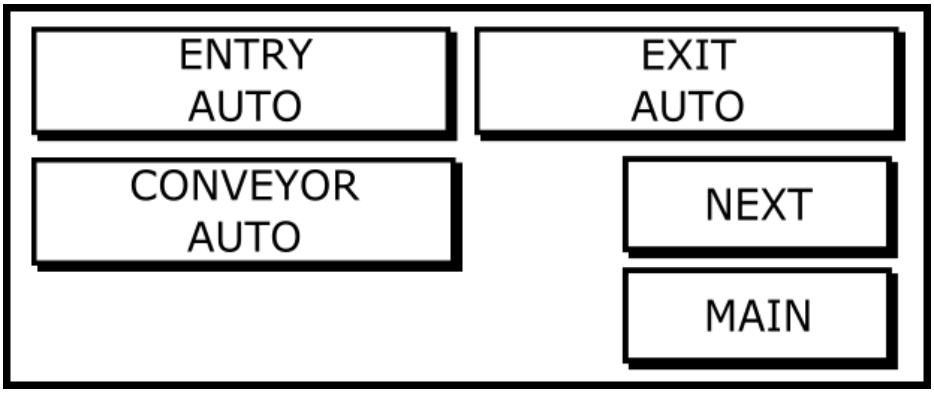

Figure 6-8
Manual Toggle Screen 1

The series of manual toggle screens allow the operator to directly access the various functions of the machine.

On the first screen, the Entry Gate, Exit Gate, and Conveyor can be directly controlled

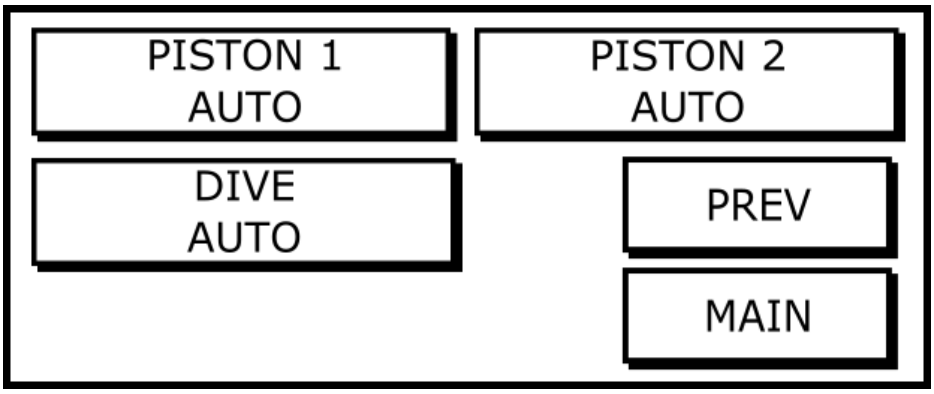

Figure 6-9
Manual Toggle Screen 2

Similar to the first Manual Toggle Screen, the second screen allows the operator direct access to several functions.

On machines equipped with more than one piston drive, each can be activated individually.

The dive cylinder can be activated manually here as well. This is used for set up and changeover to verify proper depth and stroke of the dive, as well as aligning the two upper dive stops (*Fig 5-2*)

6.5 SET UP SCREEN

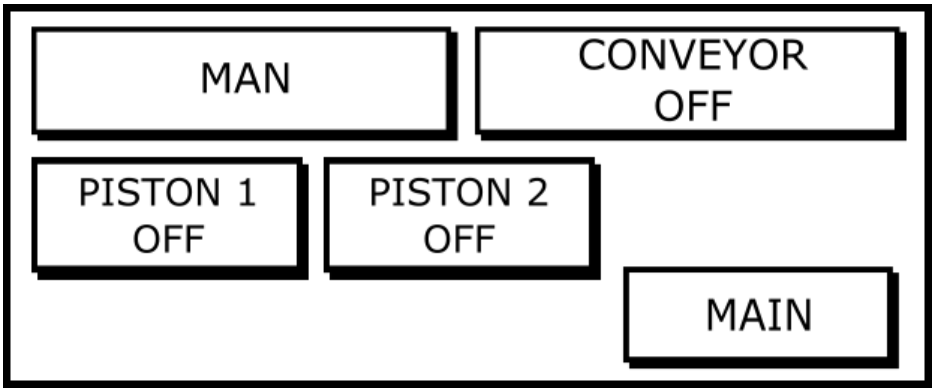

Figure 6-10
Set Up Screen

This screen allows discrete control over the individual components of the machine.

The filler can be set to Manual or Automatic mode, the Conveyor can be set to run Automatically (typical setting), to run Continuously, or deactivated.

If the machine is equipped with more than one piston drive cylinder, each can be activated or deactivated on this screen, if for instance, one is taken offline for maintenance.

6.6 FRONT PANEL CONTROLS

Typical controls available to the operator are shown in *Fig 6-12*

The primary operator interface touch screen, Emergency Stop button, Main Power Disconnect, and Conveyor Controls are generally mounted on the front panel.

Other toggles may be present, depending upon the configuration, please refer to machine specific documentation for custom configurations.

Figure 6-11
Front Panel Controls

6.7 AIR SOLENOIDS

Air solenoids, typically mounted to the side, or rear, of the main control box, provide pneumatic logic control for the machine operation. An electrical signal, sent from the PLC, activates the solenoid attached to the air valve, switching the air pressure from one port to the other, extending or retracting the connected air cylinder (indexing gates, dive cylinder, drip tray cylinder, etc)

Solenoids may be manually activated by pressing the orange button located on the face of the solenoid assembly to assist with troubleshooting.

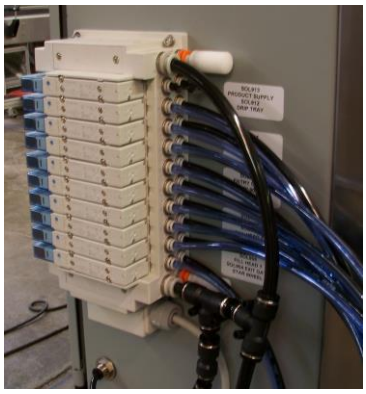

Figure 6-12
Air Solenoids

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7.1 FACTORY CONTACT INFORMATION

7.2 CONTACT APEX DIRECTLY

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